


Auction at a High Level

- Selection
- Ranking
- Pricing
- Auction adjustments
- 1p auction
- Risk

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Ads Selection

- Ads can match on:
 - Contextual
 - Keyword, site, topic/vertical, etc.
 - User
 - Demographic, in-market, user list, etc.
 - Auto-targeting
 - We select targeting based on performance


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Ads Selection

- Adgroup server:
 - Indexed: millions of ads
 - Match: thousands
 - Shard auction: hundreds
 - Return to auction: tens
- Shard auction runs to approximate mixer auction
 - Simpler models for pctr, pcvr, etc.


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Ads Selection - low identity

- What if we don't have user signals?
 - Contextual fallbacks
 - Map from contextual signals to demographic/audience (e.g. generalize from where we do have cookies)
 - More auto-targeting
 - Broader contextual matching
 - Increase signed-in users
 - E.g. pubs SSO through Google


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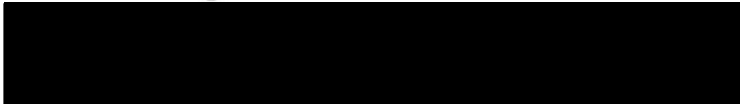
GDN Auction Ranking

- Advertisers can pay per
 - Click
 - Conversion
 - Engagement
 - Active View
 - TrueView (video)
- Convert all bids to maxEcpm (max expected cost per 1000 imps)
 - e.g. $1000 * \text{maxCpc} * \text{pCTR}$
- maxEcpm lets us compare ads in the same space

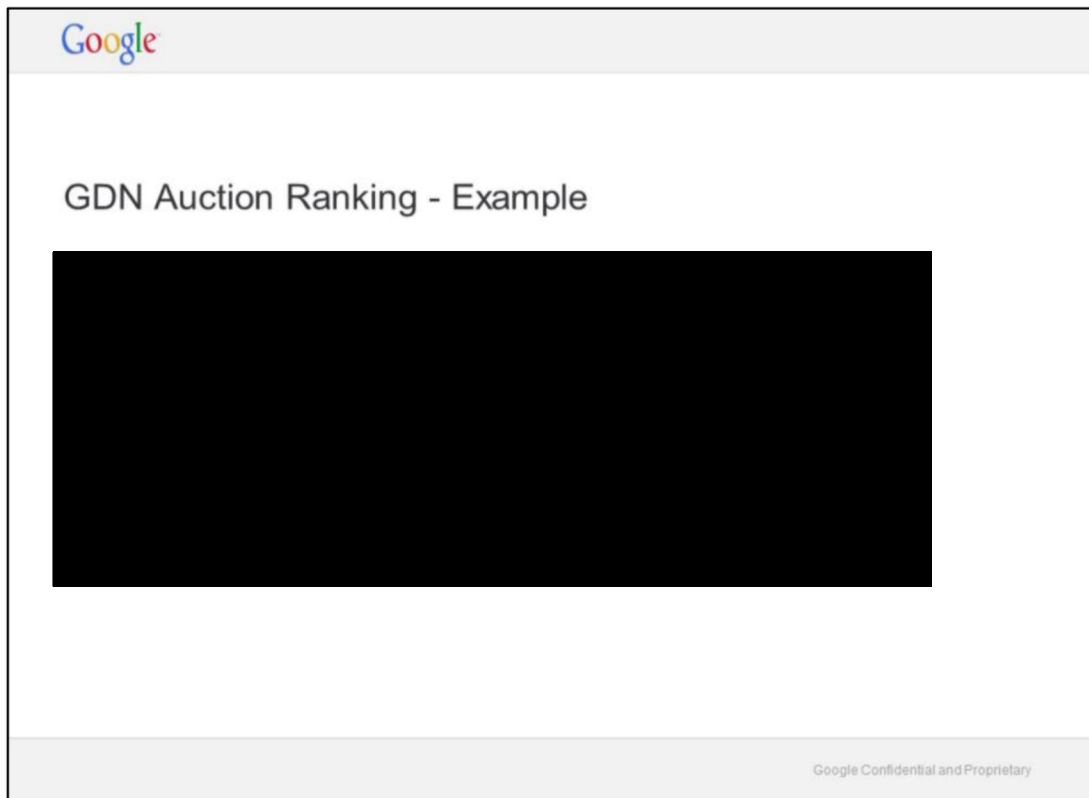
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GDN Auction Ranking

- We have auction ranking scores for each ad BUT we need to pick the best **configuration** of ads...
- 
- Dynamic resizing within non-full-slot auction
 - N ads requested; can we do better by showing <N?

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GDN Auction Pricing

- Second price (single ad)
 - Pick highest maxEcpm, use second highest to set price of winner
- VCG (Vickrey-Clarke-Groves) pricing
 - Generalization of second pricing (e.g. multiple ads)
 - Remains a truthful pricing mechanism
 - Prices auction winners according to counterfactual: how much does the winning ad cost other ads by participating the auction?
- Dynamic resizing and VCG matter for multiple ads
 - Currently we show 1 ad vast majority of queries
 - However this is becoming important again with formats such as video pods

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Auction Adjustments

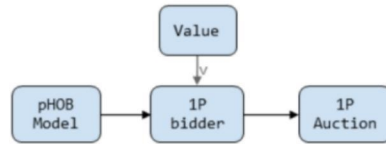
- GDN auction score is a function of maxEcpm and other adjustments
 - Fees (e.g. 3p data)
 - Quality adjustment
 - Fixed fee (additive) - e.g. mute-based fees
 - Auction score multiplier
- Problem with adjustments: inconsistency across stack
 - Shard auction may not return best set of ads
 - Combined auction is pure CPM
 - Quality adjustments hurt GDN competitiveness
- We are trying to move toward pure ecpm

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First price auctions - computing bid

- Objective: Max expected surplus or profit
 - surplus = value - bid if won
- Ingredients:
 - Value or $E[\text{value}]$: This is what we bid in 2P auctions
 - Predict competition aka Highest Other Bid (HOB)
- Optimal bid
 - Maximizes $E[\text{surplus}]$
 - Function of value and CDF_{HOB}

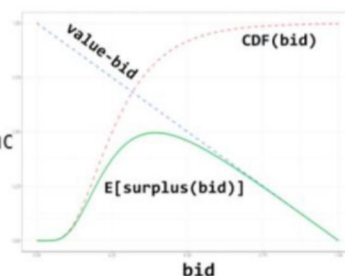


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How to compute 1st price bid?

- Objective
 - $E[\text{surplus}(\text{bid})] = (\text{value} - \text{bid}) * P_{\text{win}}(\text{bid})$
 - $P_{\text{win}}(\text{bid}) = P(\text{HOB} < \text{bid}) = \text{CDF}_{\text{HOB}}(\text{bid})$
 - Product of two curves (decreasing and increasing)
- Optimal bid
 - Maximizes $E[\text{surplus}]$
 - Function of value and CDF_{HOB}

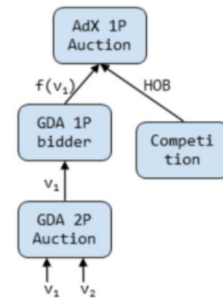


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Preserving incentive compatibility [go/gda-1p-bidder-advertiser-incentive](https://www.google.com/go/gda-1p-bidder-advertiser-incentive)

- Most spend on GDA is from auto bidding
- Auto bidding products designed in 2P world
- Incentive compatibility is critical to keep them working
- GDA internal auction stays 2P
 - v_1 : value of GDA winning ad
 - v_2 : value of GDA runner up
- Winner charged min value to win query
 - Win internal auction: $v > v_2$
 - Win AdX auction $f(v, ..) > HOB \Rightarrow v > f^{-1}(HOB)$
 - Cost = $\max(v_2, f^{-1}(HOB, ..))$



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Risk

- Charge advertisers on click but pay pubs on impression
 - Risk: what if we mispredict?
 - Opportunity: arbitrage (dynamic margins, Bernanke)
- How to mitigate risk?
 - Revenue calibration: measure eRevenue/Revenue, adjust bids to correct
 - Shield: detect and react to tail risks (large misprediction for particular advertisers/publishers)

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Future Work

- Launch 1p smart bidder on apps (currently using bid translation)
 - Additional challenges in apps:
 - HOB inaccuracy due to mediation chains
 - On-platform competitiveness vs off-platform
- Combinatorial auction at combined auction level (GDN, DBM, RTB)
 - Video pods
 - SRA
 - Multi-ad UI (MAUI)

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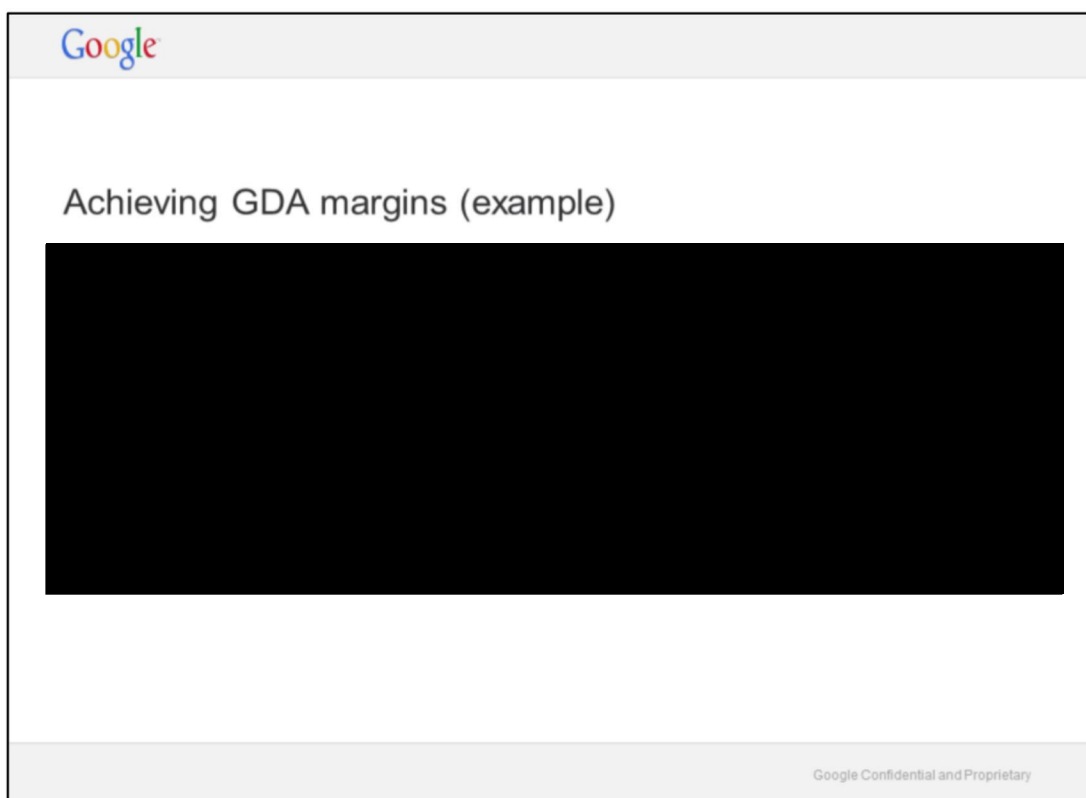




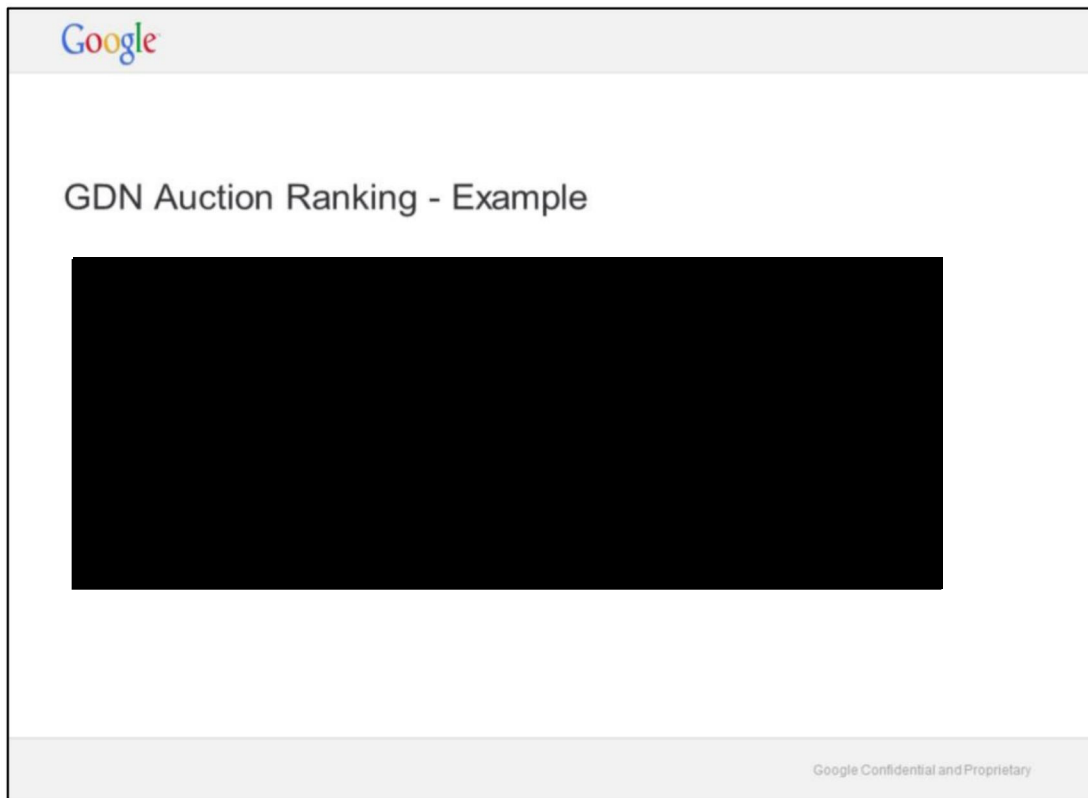
Achieving GDA margins

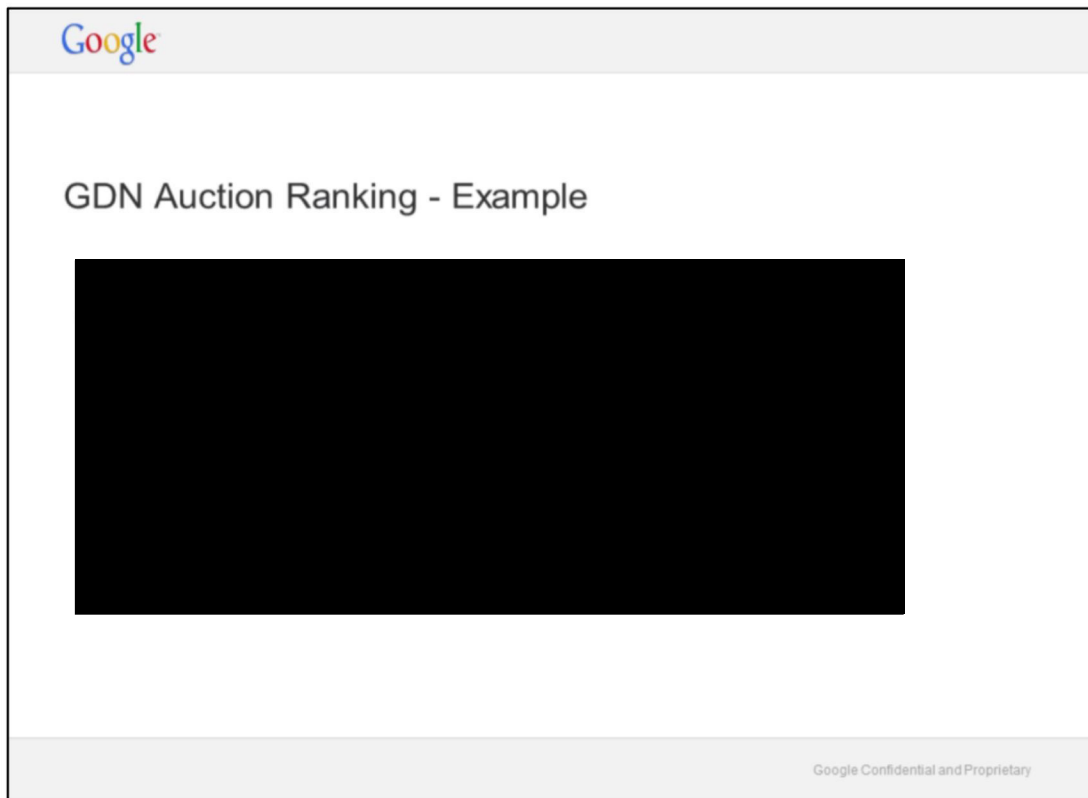
- GDA: Aggregate margin of 15%
- Surplus maximization + Incentive compatible pricing => margin ??
- Revenue: charge advertiser $\max(f^1(\text{HOB}), v_2)$
- Payout: pay publisher first-price bid

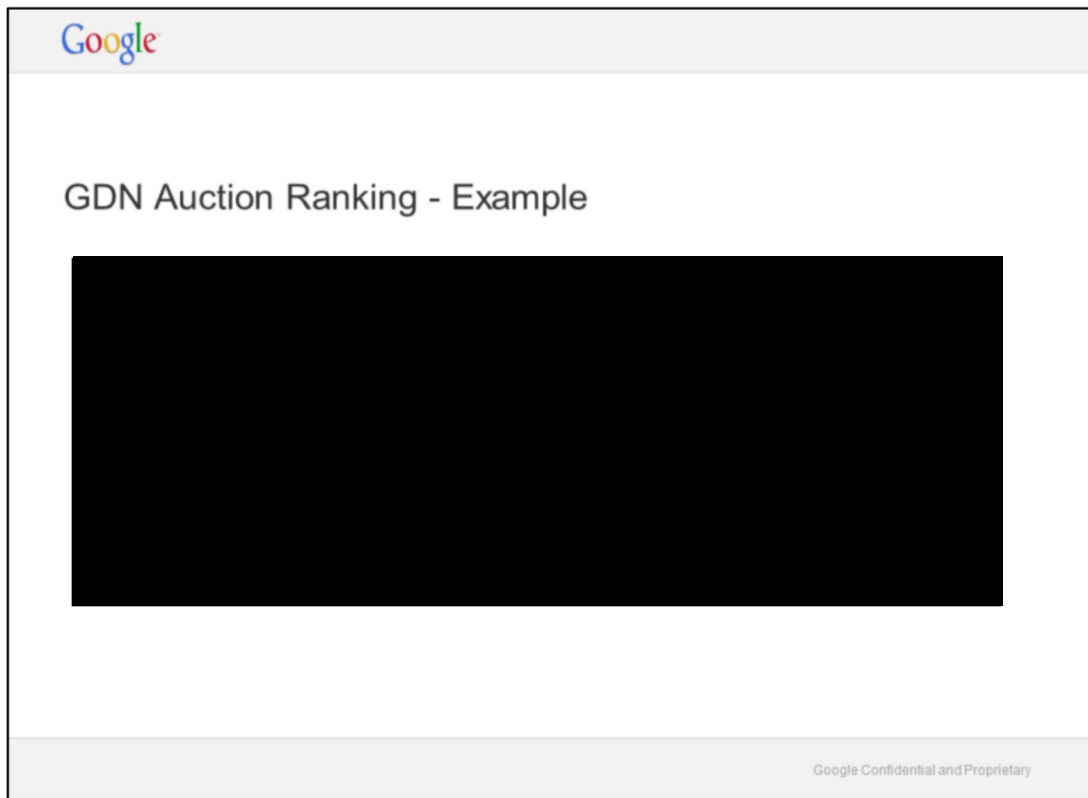
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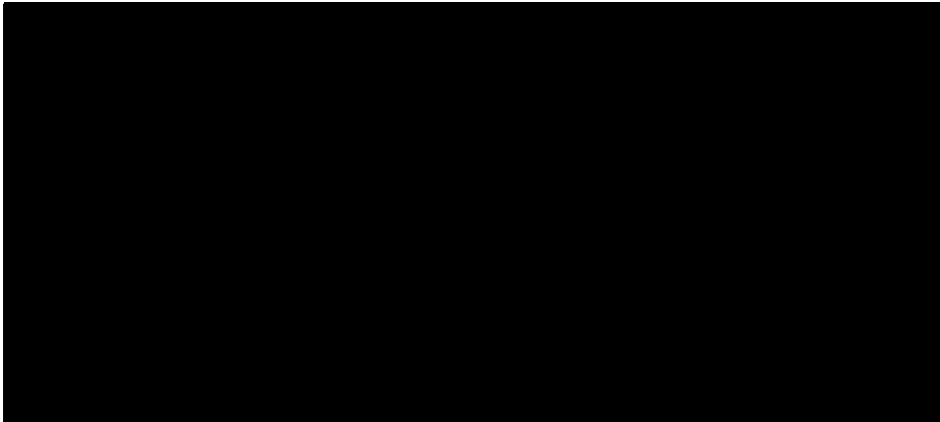









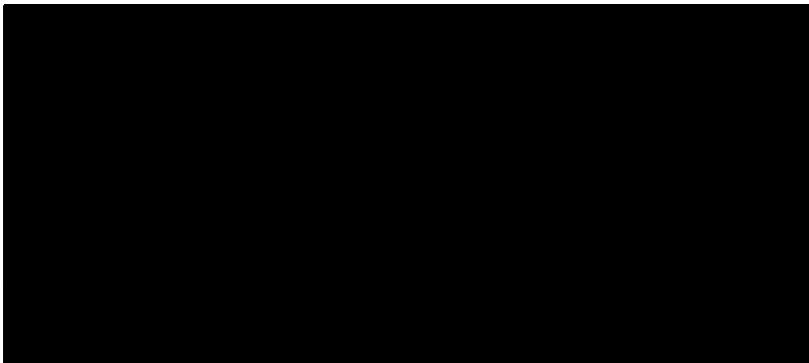
GDN Auction Pricing - Example



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GDN Auction Pricing - Example




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How does ads UI affect pctr/auction?

- Choice of rendering/UI affects pctr and position normalizers
 - May change tradeoff between text and full-slot sub-auction
 - May change optimal dynamic resizing decision
- UI normalizers as generalization of position normalizers
- UI versions are a feature in the model
 - feature is a fingerprint of repeated (key, value) pairs
 - e.g. key = RENDERING_STYLE, value = {SIMPLE_UI, MAGAZINE, CAROUSEL, ...}

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How does rendering affect pctr/auction?

- Experiment with changing the UI?
 - Send the new UI in the request, let the model predict on it
- Experiment with multiple UIs?
 - Send multiple UIs in the request, model predicts position normalizers for all of them, auction chooses the best

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